DC-5 & R3D-1 and R3D-2

It was in the spring of 1939 that Carl Cover, then Senior Vice President in charge of Sales for the Douglas Company at Santa Monica, became very interested in developing a twin-engine airplane for private use and he had the idea of re-designing a twin-engine bomber then under consideration for the Air Force that later became the Model DB-7. As the commercial transport design progressed, it soon became evident that the relatively narrow fuselage and small wing of the DB-7 would not be suitable for a commercial transport. The design, therefore, grew in size until it rather closely resembled the DC-3, although, due to the high lift devices employed, it had a considerably smaller wing area than the DC-3. The first work order for DC-5 airplanes was issued on May 22, 1939 for four airplanes. A second work order for one airplane was released on April 18, 1940. This one was for Mr. Boeing, then head of the Boeing Aircraft Company to be outfitted as his own personal executive transport. The Navy's interest in a new transport paralleled the development of the first DC-5 and an order for seven aircraft was received on September 5, 1939 under Navy Contract C-68537. The Navy's R3D's were powered with a Wright GR-1820-44 engine that the Navy carried in their inventory, whereas the DC-5's were powered with GR-1820-G102A engines. The Navy transport actually had two designation numbers, R3D-1 identified the basic transport equipped with seats for personnel transportation and the R3D-2, a cargo version with a larger rear door later to be used by the Marine Corps. A first flight was

made a year after authorization to proceed and the last of the twelve airplanes was delivered by the end of 1940, a great credit to Al Leonhardt, the Project Engineer.

In general, the program progressed well, There were few problems aerodynamically or structurally with the exception of a triple-slotted flap that was intended to considerably reduce stalling speed so that the DC-5 could operate from shorter fields in what is now referred to as "stol mode". The wind tunnel tests showed the flap to be very promising and that it did indeed reduce the stalling speed. However, the mechanism was such that there was considerable buffeting or movement which concerned Carl Cover and the other pilots to the extent that, after a few flights, they decided it was too much of a gamble and the design was altered to a simple slotted flap.

As the flight test progressed, another problem showed up, at least in the mind of Carl Cover, who was then well-recognized by the El Segundo organization as Executive Vice President, Chief Salesman and also Chief Test Pilot. This situation for observation, according to Carl, was a tremor that he occasionally felt in the horizontal tail. Much time was spent in flying in rough air to try to measure this buffeting and determine its frequency and magnitude. On one day, for example, a flight started out at Mines Field, headed out over the ocean to Catalina Island, then flew back along the entire Palos Verdes Peninsula, on the very edge of the Palisades, looking for rough air to excite the alleged buffet. It continued through the Pomona Valley at altitudes of less than a hundred feet,

then through the coast range of mountains from Mount Baldy to Mount Wilson and on toward Mount Gleason. From there down the Antelope Valley side, out over Edwards Air Force Base, not yet than named Edwards, and finally, after exhausting the fuel supply, returning to Los Angeles and landing at Mines Field.

During this time, Leo Devlin, then Chief Designer, John Wheatly, Chief Aerodynamicist, and Ed Heinemann were in the airplane in all possible locations, including Heinemann crawling back into the tail cone with his head between the levers operating the rudders and elevator, trying to feel, sense, measure or determine the nature of Carl's buffeting. To this day, it is not known whether it really existed in any noticeable fashion or whether it would have been objectionable. Still, Carl being such an excellent flyer, his reaction should not be taken lightly.

Finally, after exhausting all other means of sensing, a young engineer by the name of Paul Dennis designed a very ingenious device consisting of some vertically mounted aluminum tubes forward of the horizontal tail on one side, about two feet apart, mounted on a structurally solid boom extending from the side of the fuselage, with an electric light bulb socket about every six inches in the vertical plane on each of the vertical rods, into which he screwed automobile headlight bulbs from which the glass had been carefully ground off, leaving only the exposed filaments. With great ingenuity he had hooked these up individually to an oscillograph in such

a manner that during a flight he could measure the aerodynamic cooling effect on each one of the filaments, thus giving an indication of the turbulence that flowed over each sensor. The device worked unusually well, and resulted in a grid of the span of the horizontal tail and approximately six feet high that clearly showed that the wing turbulence was somewhat parallel to the stabilizer which one might have expected, but that no one thought would be of such a magnitude that it would have any effect on the tail. This, nevertheless, did strengthen Carl's argument for putting some dihedral in the horizontal tail to raise it out of the wing weight, which was quickly done. It seemed to work, at least to the satisfaction of Carl Cover, and the dihedral was then installed on all of the airplanes.

Another oddity of the DC-5 was the fixed leading edge slats on the outer part of the wing that were tried experimentally to see if stalling speed could be lowered. Many flights were made and elaborate ground instrumentation was set up to measure the speed during landing, but could not be shown conclusively that the stalling speed was lowered by any significant amount. They did, however, have the effect of improving the aileron effectiveness at low speeds near the stall and once they were on the experimental airplane, the Dutch representative insisted they be on all the airplanes. The Dutch were found to be very shrewd purchasers of aircraft, good engineers and excellent pilots, and always got their money's worth for their government.

The Chief Pilot for the Dutch was Dr. Vandermaas who was

at that time in charge of the aerodynamics department at the Delph University, as well as head of the Dutch equivalent of our FAA. He was, therefore, well qualified as an engineer and a test pilot, as well as a government agent to flight-test the DC-5. With him on most of the flights was Douglas El Segundo Engineer Bill Benson, the son of the President of the Brooklyn Dime and Savings Bank, a very fine engineer with great promise. In the original specification of the DC-5, the ability to recover from spins was mentioned and it was, therefore, the interpretation of Vandermaas that he must demonstrate this point. It wasn't customary at that time to spin transports in the United States, but that did not bother Vandermaas. Each morning during the spin trials and the other phases of the flight test program, he would make out his test program card with Bill Benson, then say a prayer and take off for the airplane. Bill couldn't quite understand why he took the chances he did, but Vandermaas' logic was that with a wife and eleven children in Holland, he could make no mistakes, he had to do the job. He had to go back home to take care of them, and, therefore, Douglas had nothing to worry about. Bill's big worry, of course, was that Vandermaas included him in his prayers each morning.

Vandermaas must have prayed well, for through his entire test program there were no incidents and it was agreed that he and Bill did an excellent job. Not so fortunate, however, was Bill, sometime shortly thereafter. He was in one of the Navy R3D-1's together with the crew consisting of the pilot,

Bill Brogan, a mechanic and an inspector who had been making a series of aileron flight tests to determine the optimum rigging of the ailerons and the other control surfaces. On a Friday evening, when the tests were almost concluded, the pilot decided he wanted to try one more change in the aileron ratio. All four of the group stayed on that evening to re-rig the system preparatory to a flight the next morning. On Saturday morning the airplane was checked over by the crew, the engines warmed up and a take-off executed in a westerly direction which appeared quite normal to the observers on the ground. About the time the airplane had reached 800 feet and was about to cross the beach at the west end of Mines Field, it was seen to go through a rather erratic maneuver, entering a gradual turn to the left, heading south, losing altitude and crashing into a hill just before reaching the El Segundo Standard Oil oil refinery. The airplane broke into many pieces and burned and all four of the crew members were lost.

Heinemann, who had been at his office and did not see the take-off or know about the incident until he received a phone call, quickly drove to the scene, but by that time the bodies had been removed. He returned to his office, after making sure that the ground party and the police had salvage operations under way to execute an investigation at the factory, but had no sooner reached there when a phone call was received from the coroner asking him to come down to identify the bodies. This, to him at this age, was one of the most difficult things he had ever been called upon to do and is a job that took over an hour

and left him in a rather serious state of shock. He nevertheless got back to the office to organize the detailed investigation which several days later proved that the aileron cables had been reversed the night before the flight, after they had been worked on, even though in the engineering specification and design notes it had been decided that the turnbuckles should be so located that it would be impossible to hook the controls up backwards. This was, of course, a great blow to Heinemann and a considerable loss to the Navy. And it was probably this, among other accidents, that caused a well-known Naval engineer, Admiral--but then Captain--John Murphy, to originate what we have since learned as "Murphy's Law".

The airplanes were all completed and delivered, and met or exceeded all the requirements in the end, except for a one-knot deficiency in stalling speed and an increase in gross weight, even though the useful load was considerably increased for the Navy Department beyond its original specification. For these two deficiencies, nevertheless, a penalty was negotiated, even though a modest one, by Heinemann and Admiral Arthur Miles for a relatively few dollars, of the order of a hundred dollars per airplane, for which Admiral Murphy never quite forgave Heinemann, as he felt the penalty should have been much greater. Heinemann never did convince Murphy that the thousand pounds additional useful load that the airplane would carry more than offset the slight penalty in the stalling speed and gross weight.

On the strength of the relatively successful nature of

the DC-5 and R3D airplanes, letters of intent were received from various airlines and airline interest began to increase. Parts were even released for a block of airplanes to be built for commercial use, but it was during 1941 that the pressure of production airplanes for the military was becoming so great that it became obvious to the Air Force that the nation could only have one transport of that category. Heinemann was let down easily, however, by General "Hap" Arnold, who came to his office one day and said that he wanted to go take a tour through the shop. Heinemann, of course, always being pleased to show his wares off to the "big brass", jumped to his feet and started the usual factory tour. About halfway through the shop, while looking at the DC-5, "Hap" Arnold put his arm around Ed and said, "Ed, I hate to do this to you, but we can only afford one transport airplane. We've got to set up a big plant to build all the transports we can. We can't afford two, and we've decided it'll have to be the DC-3 because they are so much further along and it's been built for so many more years, so we'll have to cut out the DC-5." Well, this was quite a blow to young Heinemann, but Arnold told him of some of his plans and all the things that he would have to do in the years ahead and, after a very sobering consideration of the problem, he had to agree that "Hap" Arnold was right. . . and the DC-5 was discontinued forever.

QUESTIONS CONCERNING DOUGLAS DC-5

1. Q: What month and year was the first DC-5 completed and flown?

   A: February 20, 1939.

2. Q: Why was the DC-5 developed? Airline interest? Military design competition? DC-3 replacement?

   A: The company felt that there was a need for a "feederliner" to service small towns. It was not a DC-3 replacement but a widening of the Douglas product line, i.e., DC-3, DC-4, DC-5.

3. Q: Is any one man on the Douglas design engineering "team" given special credit for developing the airplane?

   A: E. H. Heinemann - Formerly Chief Engineer, El Segundo Division, Douglas Aircraft Company.

4. Q: Did the plane have any particular "bugs" or encounter any peculiar troubles in being accepted by the customer?

   A: Prototype had "tail flutter" but problem solved by (1) changing location of exhaust stacks, (2) changing from single spar to two spar wing structure to "stiffen" wing and stop irregular airflow overtail and (3) adding dihedral to horizontal tail.

5. Q: Was it certified with an Approved Type Certificate by the then C.A.A.? If so, what was the TC number?

   A: 727

6. Q: I recall that some were purchased, or at least used, by the Navy or Marines. Was the Navy designation "R5D" ??

   A: Navy R3D-1, R3D-3; Marines R3D-2

7. Q: How many airplanes were built? Can you tell me how many went to what customers? All to the Navy, or were there other sales?

   A: 1 to William Boeing (not Boeing Aircraft Co.)
4 to KLM (3 later acquired by USAAF ASC-110)
3 to USN
4 to USMC

8. Q: When did production end on the DC-5?

A: Last plane delivered October 22, 1940.

9. Q: Was production ended because of the war, i.e., was it considered faster and more feasible from a military standpoint to concentrate on DC-3 construction?

A: Production ended because it was designed as a short range feederliner. At the start of the war, the requirements were for the longer range aircraft.

10. Q: Can you tell me whether or not pilots liked the airplane? Was it forgiving and dependable and beloved like the DC3? Did it have any outstanding characteristics, such as speed, range, load carrying ability, ability to carry ice, easy maintenance, or did it, as a good Douglas product, have all of the good characteristics it should have?

A: Yes.

11. Q: Did it have any outstanding bad characteristics which made it unsuitable for an airline or military transport to be built in large numbers?

A: Not after fixes noted in 4.

12. Q: What were the empty and gross weights?

A: Gross WT 21,000#
Empty WT 13,862# (R3D-2)
Empty WT 14,747# KLM

13. Q: What engines were used?

A: Prototype, Wright GR-1820-G2A KLM-Wright GR-1820-G102A
R3D-1,2 Wright R-1820-44

14. Q: It is my impression that the DC5 is of the same period as the B-18, the B-23 and the C-47. Were any of its major components such as wing panels, tail surfaces, landing gear components, etc., interchangeable with the other three airplanes?

A: The systems were similar but no parts were interchangeable except control column.

15. Q: Was the high wing design used for greater passenger visibility, as a possible sales aid to the airlines, or was it designed as a high wing airplane for some other reason, such as a lower fuselage for military loading operations?

A: High wing allowed better passenger visability and did not require ground handling equipment such as passenger loading ramps that might not be available at small airfields.

16. Q: How many passengers was the plane designed to carry?

A: 22 max.

17. Q: (I have been unable to find the published specifications in any of my old magazines,) Could you list an "average" cruising speed and at what altitude, with full load? And an average range in miles at this speed?

A: See attachment.

18. Q: Do you list any magazine article references on the plane, which I might find at my library?

A: Aviation, February 1940.

19. Q: Various transport airplanes are listed as introducing certain improvements, or big advances in design. Is the DC5 remembered for any innovations? Did it influence the design of the C-54 in any particular way? Is the resemblance of the Fokker F-27 to the DC5 more than coincidental?

A: What can a high wing, twin engine transport look like? An aircraft designer has only the basic fundamentals to work with.

20. Q: In the above reference to the present Fokker (Fairchild) F-27; I have been told that Boeing originally designed a plane along the lines of the F-27, and sold it to Fokker. And of course Beech is accused of having copied the Twin-Beech series from the original Lockheed 12. So I thought it possible Boeing might have had a good luck at a DC5 and filed it away for after-the-war reference. Do you have any comment on this?

A: You cannot say one aircraft is a copy of another simply because of a generalized external appearance, you must compare the systems. On this basis it is evident the aircraft specified are not carbon copies.

21. Q: Do you know whether or not any DC5s are still in existence, and whether or not they are flying?

A: None flying. Last plane scrapped in Isreal about 1956 or 1957.

22. Q: Referring again to specifications: was the DC5 conventional in construction and similar to other Douglas products? Were the gear and flaps hydraulically operated?

A: Yes.

23. Q: Did the airplane see service in World War II and if so, was it in any particular domestic or overseas service?

A: One R3D-2 destroyed at Pearl Harbor, December 7, 1941; others also based there. Navy aircraft were at Anacostia.

24. Q: Do you list any specific names or numbers of the military squadrons, wings, groups, etc., that used the airplane?

A: R3D-2 were in VMJ-2, VMJ-1, VMJ-152 at Pearl Harbor, El Toro, North Island R3D-3 (Prototype to Wm Boeing to USN) used in Aceutians for mapping. Later stationed at Nas Alameda.

25. Q: Was the DC-5 ever used to drop paratroopers or tow gliders, like the DC3?

A: Marine R3D-2 used to train paratroopers.